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MINDSET TYPE VERSUS LEVEL OF CORTICAL ACTIVATION

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SUMMARY

Background The concept of mindset, developed by P. Gollwitzer, distinguishes motivational and volitional elements in the action process. The mindset is a relatively constant tendency displayed by individuals and observed in many situations, and activated when an individual becomes involved in a given action. The main aim of our study was to discover differences in cortical activity in the predecisional and the preactional phases of the action process.

Material/ Methods: The study involved 32 persons. The participants were connected to an EEG and the results were recorded. The progress of stimulation was registered by a computer. The test consisted of three phases: deliberation, relaxation and implementation.

Results: The results of our experiment, which point to significantly higher cognitive activity in the predecisional phase as opposed to the preactional phase, seem to confirm the theoretical assumptions and indicate the existence of a qualitative difference between these phases.

Conclusions: The subjects' cognitive activity in the predecisional phase resembles task-solving based on heuristic instruction, although in contrast to this activity, the goal here might be unknown. The preactional phase, on the other hand, might be compared to solving an algorithm-based task and is firmly connected with developing a certain strategy allowing goal attainment and the planning of actions. This mental functioning has a strong impact on brain activity.

Key words: action phase, deliberative and implemental mindset, cortical activation, cognitive functioning

INTRODUCTION

The concept of mindset introduced by Gollwitzer (1996, 1997) distinguishes motivational and volitional elements in the action process, which delineate the various phases, on the basis of which action occurs. The basis for this distinction is formed by acknowledging the existence of a difference between the processes taking place when the goal which an individual intends to attain is being set, and the processes which take place during the actional phase.

According to Gollwitzer (1996), the predecisional phase, with its motivational nature, constitutes the first phase of the action process. During this phase the individual makes choices between desires. These choice preferences are based on the likelihood of success and importance for the individual of fulfilling a wish at a certain moment in time. Making a decision leads to establishing the action goal. According to experiments conducted by Błażek and Kadzikowska-Wrzosek (2002), the process of goal construction has a great impact on achievement and influences the emotional functioning of the individual.

The next step on the path towards the attainment of one's goal is activating the preactional phase, which is of a volitional character. At this point, the individual establishes when, where, for how long and in what way action leading to the goal will take place. Initiation of the activities essential for realizing one's intention happens in a simple, often automatic, way when dealing with routine activities. During our lifetime, however, we are frequently faced with situations which call for a conscious decision and the working out of new strategies for goal attainment. All such situations need prior preparation in the form of an action plan. Nosal (Nosal, Bajcar, 1999) additionally stresses that, thanks to the planning of realization activities, the subject gains real control over time in terms of its effective use and the shaping of the future perspective. This connection was confirmed by the results of Zaleski's research (1991), demonstrating that distant goals, whose achievement is related to the setting of a number of subgoals and the cognitive organisation of future actions, favor the structuring of time, simultaneously influence the perception of the chances of reaching a goal as higher and intensify perseverance and contentment.

The next step in Gollwitzer's model (1996) is the actional phase and setting action in motion according to a previously designed plan. This phase calls for continuity and perseverance, the supervision of realization activities and progress in the process of goal attainment. A basic role is played by the processes of action supervision, which are volitional processes. In this phase an individual is obliged to respond to the expectations posed by his/her environment, and tries to observe hints or possibilities in the situation as to the attainment of his/her goals.

The last phase of action is the evaluation or postactional phase, where the subject carries out an assessment of the results obtained and compares them to the standard which they intended to achieve. It is (sadly) a frequent occurrence that the results achieved by the subject do not meet expectations. The individual might therefore react to this situation by lowering their standards and conclude that the level reached may, albeit not entirely, satisfy their expectations, but they may also decide, if possible, to continue their actions to fully meet the standard. As Gollwitzer (1996) additionally demonstrates, during the evaluation phase the subject not only looks back to assess what they have achieved in relation to what they had planned, but also looks forward, as other wishes and aims begin to surface, which now seem more realistic and desirable than previously. The postactional phase is therefore once more a motivational phase, where the subject makes a decision as to what they intend to do next.

The phase action model as proposed by Gollwitzer (1996) has inspired the creation of a model of mental functioning, aimed at explaining human activity at various levels of goal attainment, and indicating existing differences in the individual's mindset at different levels of action. The type of mindset is a relatively constant tendency displayed by the subject and observed in many situations, and activated when the individual becomes involved in a given action.

In Gollwitzer's estimation, the model may find application in the action process, since, in fact, at various levels of this process the individual develops a different mindset. Through extensive research, the author has proved that people, when asked to think about their desires, develop a different orientation, labelled by the author as the 'deliberative' mindset, whereas those asked to plan actions towards achieving a very important personal goal, developed an orientation described as the 'implemental' mindset. In the case of goal construction we are, therefore, dealing with an action of a cognitive nature, while striving to achieve a goal involves cognitive and implemental processes alike. Further research by Gollwitzer and his colleagues (Heckhausen, Gollwitzer, 1987; Gollwitzer, Heckhausen and Steller, 1990; Beckmann, Gollwitzer, 1987; Gollwitzer, Kinney, 1989), which was designed to capture the characteristics of both types of mindsets, demonstrated that they differ significantly as to the following features:

- openness to process available information, where high openness was characteristic of the deliberative phase, and low openness of the implemental phase;
- focus on deliberation over the likelihood of achieving the aim and its importance for the subject vs. focus on plan implementation;
- impartial analysis of the information connected with the importance of a given goal vs the partiality of the analysis;
- accuracy in assessing the likelihood of fulfillment in the deliberative phase vs. (excessive) optimism in the implemental phase.

This research was undertaken to find out whether the cognitive activity of an individual in the phase of deliberating the goal, the possible consequences, value and usefulness of a given goal (predecisional phase) is higher in relation to the phase in which the cognitive activity of the subject is focused on the methods for its attainment and the conditions in which the goal should be attained (preactional phase). As has been stressed by Gollwitzer (1996), in this latter phase the subject has already made the decision as to how, where and when the actions connected with attaining the goal should be undertaken. In this research, the main focus was to discover the difference in the process of cortical activation in these two phases. Our assumption was that cortical activation or, to be more precise, the attenuation of alpha wave activity as a result of heightened brain activity, must be higher in the predecisional phase in comparison to the preactional phase.

Therefore we proposed the following research questions:

1. Do differences exist as to cortical activity in the selected phases of the action process, i.e. in the predecisional and the preactional phases?
2. Are these differences (if indeed they surface) independent of the content of the intended goals or action plans?

MATERIAL AND METHODS

The study involved 32 people, students of psychology, geography and mathematics, between the ages of 19 and 24 (the mean age was 20.4). The group consisted of 10 men and 22 women. The participants took part in the research voluntarily, aware that a measurement of electromagnetic brain waves would be taken.

The research was of an individual nature and was conducted in the Mental Diseases Clinic at the Gdansk Medical University, with the consent of the director. The participants were connected to EEG devices and their results were recorded. The stimulation progress was registered by a computer. The test consisted of several phases.

In the initial phase the participants were asked to close their eyes and relax as much as possible. They received oral instruction not to think about anything, but to imagine a clean sheet of paper, and not to move their pupils. After a period of about five minutes, the measuring device was disconnected and the subjects rested for ten minutes.

The next phase started with the subjects receiving instruction to think with their eyes closed about a goal which they had decided to achieve and which they were absolutely convinced was personally important to them, its achievement cognitively worked out (in terms of its value and the particular actions needed in order to achieve it), and the subject aware of what needed to be done to reach a successful conclusion. The participants' deliberation on this theme lasted 10 minutes, after which the measuring devices were disconnected and the subjects asked to open their eyes and relax for 10 minutes.

The subsequent phase began with the participants closing their eyes once more and receiving instruction. This time they were asked to think about a goal or goals as to which they had not made a decision, i.e. had not clearly defined whether the achievement of these goals is important to them and whether the goals presented any particular value. In this phase the subjects deliberated on the value of a goal, the possible consequences of its achievement, etc.

For half of the participants (N =16) the procedure was reversed, i.e. the first cycle of relaxation was followed by the predecisional phase, and the second by the preactional phase. This done was used in order to prevent possible mistakes resulting from the order of the tasks.

On completion of the test, the participants noted down their objects of deliberation in subsequent phases of the experiment.

RESULTS

The results obtained in the experiment absolutely confirmed the initial assumptions and allowed for an answer to the research questions. Table 1 contains the results of a statistical analysis, which points to significant differences in the levels of cortical activity in three distinct phases: the relaxational, predecisional and preactional phases.

A post-hoc content analysis of the deliberated goals and plans was assessed by five psychologists acting as competent judges. The judges assessed the level of consistency of the subjects' deliberations with the instructions they had received. The judges proved to be in almost complete agreement, with Kendall's W at 0.97.

The value of Student's T for the comparison of mean values of activity in the relaxational and preactional phases was $t = -3.01$, $df = 31$, $p < 0.005$. For the comparison of the relaxational and predecisional phases the value was $t = -4.86$, $df = 31$, $p < 0.0001$. For the comparison of the preactional and predecisional phases the statistical value was $t = 2.59$, $df = 31$, $p < 0.01$.

The results concerning comparison of mean alpha activity attenuation for the target areas of the brain (temporal, occipital, and parietal lobes) obtained in our study are contained in the tables below.

The statistical results for the comparison of mean values of activity in the relaxation phase and the preactional phase (implementation) was $t = 1.41$, df

Table 1. Mean values of α activity (in MHz) in the state of relaxation, in the predecisional and preactional phases (N=32)

Conditions	Mean	Standard divergence
relaxation	29.62	12.88
implementation	26.59	11.09
deliberation	24.76	11.28

= 29, p = 0.169. For the comparison of the relaxation phase and the predecisional phase (deliberation), the value was t = 3.56, df =29, p < 0.001. For the comparison of the preactional phase (implementation) and the predecisional phase (deliberation) the value was t = 2.12, df = 29, p= 0.04.

The statistical results for the comparison of mean values of activity in the relaxation phase and the preactional phase (implementation) was t = 3.76, df = 29, p =0.001. For the comparison of the relaxation phase and the predecisional phase (deliberation) the value was t = 4.37, df =29, p= 0.000. For the comparison of the preactional phase (implementation) and the predecisional phase (deliberation) the value was t = 1.90, df = 29, p<0.06.

The statistical results for the comparison of mean values of activity in the relaxation phase and the preactional phase (implementation) was t = 1.48, df = 30, p =0.148. For the comparison of the relaxation phase and the predecisional phase (deliberation) the value was t = 3.25, df =30, p= 0.003. For the comparison of the preactional phase (implementation) and the predecisional phase (deliberation) the value was t = 2.14, df = 30, p=0.04.

The results obtained in our experiment (the lower the numerical value, the higher the attenuation of alpha wave activity, and therefore the higher the cognitive activity) allow us to infer that, according to initial predictions, the

Table 2. Mean values of α activity (in MHz) in the state of relaxation, in the predecisional and preactional phases at the temporal measurement point (N=30)

Conditions	Mean	Standard divergence
relaxation	27.69	12.15
implementation	26.12	11.04
deliberation	24.56	11.09

Table 3. Mean values of α activity (in MHz) in the state of relaxation, in the predecisional and preactional phases at the occipital measurement point (N=30)

Conditions	Mean	Standard divergence
relaxation	29.88	17.19
implementation	24.17	12.55
deliberation	22.85	12.16

Table 4. Mean values of α activity (in MHz) in the state of relaxation, in the predecisional and preactional phases at the parietal measurement point (N=30)

Conditions	Mean	Standard divergence
relaxation	31.35	12.77
implementation	29.78	12.69
deliberation	27.99	12.69

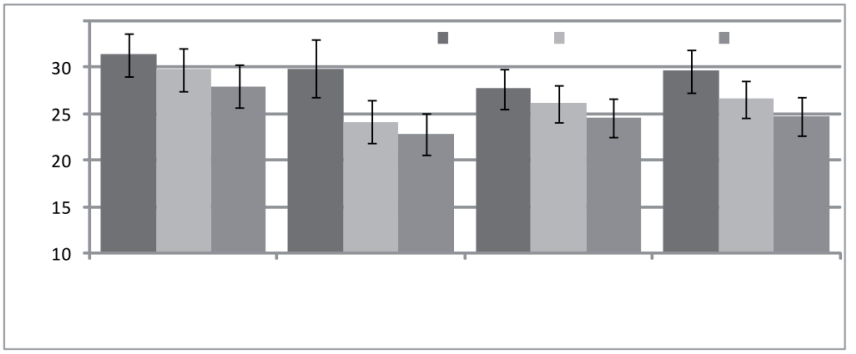

Fig. 1. Mean values of α activity for measured conditions

highest cognitive activity is indeed observed in the predecisional phase and the lowest in the relaxation phase. The preactional phase is characterized by an alpha wave attenuation indicator higher than in the relaxation phase and lower than in the predecisional phase. To sum up the result, we can conclude that the action process, whose first phase, as stated by Mądrzycki (2002), consists of planning, is a cognitively engaging process, activating the cortex and, in consequence, providing stimulation, whose appropriate level facilitates the efficient progress of realization processes. Fig. 1 presents the results showing the consistent pattern of brain activity in measured conditions.

DISCUSSION

The results of our experiment, which point to significantly higher cognitive activity in the predecisional phase as opposed to the preactional phase, seem to confirm the theoretical assumptions and indicate the existence of a qualitative difference between these two phases.

In the first of these phases, the participants have to make a decision not only as to which of their goals are at present the most important to reach and therefore worthy of the utmost attention, but they also have to consider the likelihood of attainment and the consequences. People frequently express a number of desires, wishes or goals, which constitute vital elements of their personalities, but which cannot be reached simultaneously, or the attainment of one renders the attainment of the others impossible. As indicated by Emmons and Kaiser (1996), a conflict within goal structure leads to a decline in the perception of the meaning of life and life satisfaction and, consequently, to the lowering of the efficiency of goal-oriented actions. This is due to the constant surfacing of ambivalent feelings connected with the goal, this being in conflict with other, rival tendencies. The functioning of a person in the predecisional phase does not, naturally, testify to the existence of a constant conflict, or even any ambivalence as to one's goals or desires, but can only display characteristic traits of such a state. The predecisional phase is, indeed, an element of the action structure in which the subject considers var-

ious goals and has to make a decision as to the attainment of one goal in the near future.

Numerous studies have indicated qualitative differences between the activity or, to be more precise, the cognitive functioning of a person in this phase as opposed to the preactional phase. The differences concerned such dimensions of cognitive functioning as openness to process available information (Heckhausen & Gollwitzer, 1987), orientation towards the assessment of the likelihood and usefulness of a goal vs orientation towards the implementation of a plan (Gollwitzer, Heckhausen & Steller, 1990), complete vs. partial information analysis (Beckmann & Gollwitzer,1987), and accurate vs. optimistic assessment of likelihood (Gollwitzer & Kinney, 1989).

In the first, predecisional, phase, as a result of the greater cognitive openness of the individual to absorb new information, to consider multiple options or to display higher accuracy of analysis, one deals with a heightened cognitive activity in conjunction with a display of numerous negative emotions, such as insecurity or anxiety. It may be supposed that in this phase the "self" schemata are strongly activated. The participants face the decision whether they are obliged to, want to or should achieve a given goal and whether or not they possess the resources to achieve it. As Little (1993) indicates in his research, focusing on the various aspects of the "self" does not facilitate the efficient attainment of goals. This phase additionally constitutes an element of the action process in which multiple drives and potential prospects come into play, which in turn may foster the emergence of depressive symptoms, as the subject realizes the number of plans which will have to be abandoned in order to achieve just one.

The significantly higher value of cognitive activity in this phase of the action process, a result of the above mentioned factors and ascertained through the present authors' study, makes this phase differ greatly from the second, preactional phase, in which the value and likelihood of goal attainment are no longer considered, with the attention of the subject focusing on the operationalization of the goal. In this phase, as Gollwitzer (1996) points out, the subject decides in what manner, where and when the endeavors related to the attainment of a given, pre-selected goal should commence. Therefore, on the basis of the result pointing to the attenuation of alpha activity in the predecisional phase, it may be assumed that the planning of the action strategy alone is not as cognitively engaging a process as decisional processes. This happens for a number of reasons. Firstly, as indicated in the previously quoted studies, this phase is not one where information is intensively processed; rather, the person displays considerable resistance to absorbing and considering any new information. The cognitive focus concerns the creation of an optimal action strategy, which, due to a tendency for an action strategy to be consolidated in a subject's personality, frequently tends to be an almost automatic process.

This phase of action is also less activating, due to the emotions involved in it. Gollwitzer et al. (1989) as well as other authors (Koole & Spijker, 2000) have indicated a strong influence of positiveness connected with the preactional phase. This effect is not only conducive to an increase in one's effectiveness, but also rules out the likelihood of involvement in the deliberation over alternative action methods.

In a sense, the subject's cognitive activity in the predecisional phase resembles task-solving based on heuristic instruction, although in contrast to this activity, the goal here might be unknown. The preactional phase, on the other hand, might be compared to solving an algorithm-based task and is firmly connected with developing a certain strategy allowing goal attainment and the planning of actions. The subject's experience, gathered during their lifetime and relating to goal-oriented activity, allows for the revision and application of strategies, previously experienced as efficient and effective in a given situational context.

The results presented here seem to be promising for further research concerning person with disturbed brain or personality functioning. According to Pastwa-Wojciechowska (2008) the process of planning actions among psychopaths differs from that observed among the population with no psychopathology. Also, as Radziwiłłowicz (2004) points out, patients with dementia and depression show some difficulties in forming and executing perceptual-motor plans.

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